A DETAILED LOOK AT IMPLEMENTATION RESEARCH

Michael J. Ginzberg

REPORT CISR-4

SLOAN WP 753-74

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1. Introduction

Research on implementation in the past decade has been guided almost exclusively by a single paradigm, the factor model. This research generally starts with a group of variables or sets of variables potentially relevant to implementation outcomes, and attempts to determine the relative importance of these variables or sets of variables to these outcomes (we use the term factor to refer to either a single variable or a cluster of variables, as both tacks can found in existing factor research). The basis for deciding which variables to include in a factor study is complex, as there are a large number of candidates. Two major approaches to the selection of factors for studying can be found in the literature: the inductive approach, which starts with a source of data (e.g., ease observations) and extracts those factors appearing to be important; and, the deductive approach, which selects factors for study before data collection on the basis of past research, literature review, expert opinion, etc. Certain other variations in research approach can be observed within the factor paradigm -- focusing on one particular type of factor vs. looking at a range of factors, examining a single project in depth vs. surveying multiple projects and organizations -- but in all cases the underlying question is, what factors are associated with implementation success.

Given the quantity of effort put into this single research paradigm, we could expect to find some definitive answers to the implementation problem emerging. And, a glance at the literature

would suggest that this might be the case; we all know that top management support and user involvement are critical to successful implementations. But, beyond this, what do we know about implementation; and, how sure are we that this type of management support and user involvement is important? Or, more critically, when are these factors important?

In this paper, we will review a number of these factor research efforts. We will consider the studies both individually and as a group, attempting to find the general principles which have emerged from this research paradigm. On the basis of our findings in reviewing this research, we will draw some conclusions about the most profitable avenues for further research on implementation.

2. Research Efforts Reviewed

2.1. Bases for selection.

The relatively small amount of research which has been conducted on implementation precluded the need for elaborate sampling procedures in selecting the studies to be considered in this review effort. Clearly, the most important factor for a study's inclusion was my knowing (or finding out) that it existed. While this may not seem to be the most scientific basis for selection, the studies seem to reflect the full range of research on OR/MS activities. They can be classified in terms of three important characterisitcs: 1) the settings included in these studies, 2) the measurement methodologies

employed, and 3) the dependent variables chosen. In considering these characteristics we should keep two questions in mind: are the studies included here representative of factor research on implementation? and, are they representative of research on implementation generally? Turning first to the settings included in the studies, we find a wide range of coverage -- a substantial number of public and private organizations, a variety of organization sizes, a number of cultures (U.S., Europe, and Latin America), and a variety of project types. While no single study covers the entire range, taken as a whole they seem to provide an adequate representation of the non-military settings in which OR/MS activity is taking place.

In considering the measurement methodology employed, two issues are of relevance. First, what variables were selected for measurement and what was the basis for their selection? And, second, how were they actually measured? Keen (1974) suggests that factor studies typically measure those variables which are most readily measurable, with little regard for theoretical considerations in the selection of these variables. The fourteen studies included in our sample identify approximately 140 different factors, covering a wide range of the variables potentially affecting implementation outcomes. We shall show later, however, that the distribution of research effort among these factors is far from balanced. The bases on which these factors were selected for study is not immediately apparent; few authors state explicitly why they have chosen the factors they did, and in at least six of the

fourteen studies the factors examined were abstracted from the data (normally interview or case observation based) after it was collected. We will return to this question in a later section, but for now we can state that there is no immediate grounds for dismissing Keen's conjecture. Turning to the question of measurement itself we find a variety of techniques employed, ranging from introspection, through case observation, to administration of questionnaires and the examination of company records. Thus, on the issue of the completeness of coverage of measurement methodology in our sample of studies we can conclude that the range has been adequately covered.

The third characteristic to be considered is that of the dependent variable selected and the basis for its measurement. The fourteen studies show considerable variety on this dimension, including both "hard" -- e.g., percent of projects implemented, specific types of system usage -- and "soft -- e.g., perceived project usefulness, rank ordering of perceived achievement in computer use -- measures of outcome. We will review these measures in more detail when we look at the individual studies.

In general, we can assert that the sample of studies considered displays a considerable range on each of these three critical dimensions, and that it is representative of the bulk of research on MS/OR and computer application implementation. Certain studies which could have been included in this sample were purposely excluded because they focused on a single, specific factor rather than on the more

general question of the determinants of implementation outcomes. The work of Huysmans (1970) or Doktor and Hamilton (1973) on the importance of cognitive style falls into this category, and we do not mean to deny the relevance of this work. It does, however, represent only one among the many issues potentially relevant to the implementation process, and does not focus on the central question of the factor study: "What variables are most relevant to implementation?"

The next section reviews briefly the fourteen studies we have included in our sample. We will look at the issues of setting and methodology, plus certain key points brought out by these studies. Consideration of actual results will be left to a later section.

2.2. Once over lightly: highlights of the fourteen studies.

1. McKinsey & Co. (1968): "Unlocking the Computer's Profit Potential"

While actually conducted later than some of the other studies in the sample, this work is conceptually first, as it is largely an update of an earlier McKinsey study (Garrity, 1963). The focus of this study was on those factors which differentiated more successful computer users from their less successful counterparts. The sample included 36 companies in 13 industries, covering a wide range of sizes, and located both in the U.S. and in Europe. Success was measured by judgementally ranking the 36 companies on their overall achievement with computers, and then comparing the first 18 companies with the last

18. Factors considered in this study were derived inductively, on the basis of their apparent importance to the organization's computer success, from extensive interviews with both staff and line executives. The McKinsey studies are notable both for being early in the history of studying implementation and for their best known results, the importance of top management support of and operating management involvement in the application development process.

2. Evan & Black (1967): "Innovation in Business Organizations: Some Factors Associated with Success or Failure of Staff Proposals"

Evan and Black focus on innovation, "the implementation of new procedures or ideas" (p. 519), and attempt to determine what factors affect the likelihood that an innovative proposal submitted by staff to line management will be implemented. The sample considered in this study included 52 respondents in a smaller number of companies. The respondents were either staff personnel or line managers, and each reported on one successful and one unsuccessful proposal for innovation (success being defined as the proposal's being "largely accepted and implemented by management"). Data was collected with self-reporting questionnaires asking closed-ended questions about eleven pre-selected factors. The data was then analyzed using stepwise discriminant analysis to select those factors (from among the eleven) which best separated successful from unsuccessful proposals. Seven of the eleven factors were thus found to be significant at the .05

level, though the authors claim to see no a priori reason why these should be any more important than the other four.*

3. Rubenstein et al. (1967): "Some Organizational Factors Related to the Effectiveness of Management Science Groups in Industry"

The third study considered is reported in Rubenstein et al. (1967). While we have included only the results discussed in this single paper, they are representative of other work reported by these authors (e.g., Radnor et al., 1968 & 1970). This work is concerned with finding the "necessary and sufficient conditions which permit the integration, acceptance, and growth of [innovative] activities", particularly OR/MS, in organizations; that is, the factors contributing to greater use of OR/MS. To operationalize this concept the authors examine the extent to which proposals and programs of the organization's OR/MS activity were being implemented. As no hard measure is specified, we assume that it is the researcher's impression of how well these processes were going that serves as the dependent variable. The factors considered in this study were those appearing important to the authors after some preliminary exploration. No mention is made of how variables to be considered in these preliminary studies were selected.

*We offer the suggestion that some of these factors were not adequately tested; the specific items in the questionnaire well may not be measuring what they purport to be.

factors were assessed through interviews of personnel involved in the cases studied. It is interesting to note that Rubenstein et al. are among the first researchers to suggest the potential importance of contingencies; in particular, they argue for the importance of the organization's stage in the life cycle of OR/MS activities as a conditioning variable.

4. Harvey (1970): "Factors Making for Implementation Success and Failure"

Harvey's study differs from the others in our sample in a number of respects. First, it is not truly a research effort, but more a case of group introspection to explain past successes and failures. Second, and more important from our point of view, it occurred because the author felt that the literature tended to rely too much on a single explanation -- management support and participation -- for the success or failure of OR/MS implementations, and that other factors of at least equal importance should be explored. Thus, the sample analyzed in this study consisted of 31 former clients of the author's consulting firm; this, he claims, may have biased the results, as all of these companies "were looking for state-of-the-art solutions to problems ..." (p. B313). The factors considered were those that the author and his colleagues felt, based on their experience, were important. Each of the 31 companies in the sample was ranked by the consultants on each factor. The dependent variable was simple: had the company accepted the consultants' recommendations and implemented

them. As the eleven factors selected for testing were in a sense derived from the data used to test them, it is not surprising to find that all eleven were found to correlate highly with implementation success. We also should note that the factors which Harvey initially argued should not be the sole explanations of success -- i.e., support and involvement -- are not considered at all in his study.

5. Dickson & Powers (1971): "MIS Project Management: Myths, Opinions, and Reality"

Dickson and Powers focused their attention on the "organizational and procedural factors" correlating with success in a certain class of MIS projects. The study included two projects in each of ten organizations in the Minneapolis/St. Paul area. The factors studied were selected in a relatively complex fashion. First, a moderately long list of potential factors (approximately 35) was generated by the authors and their students. This list was then submitted to a large panel of DP professionals (SMIS members) for their ratings of factor importance. Their responses (approx. 140 returned questionnaires) were used to compute average factor 'importance scores' and to develop clusters of factors (using factor analysis). A subset of these items, spanning the range of the a priori 'importance scores' and covering all factor clusters, was selected for use in this study. Additional items were included where data collection would be easy. Collecting data for the study was accomplished by extensive interviewing of management and technical personnel in each of the ten firms. Four

separate indicators of success were employed as dependent variables -- actual vs. estimated development time, actual development cost vs. budget, user satisfaction, and the impact of the project on computer operations. One of the more interesting findings of this study was the total lack of correlation among these four measures.

6. Vertinsky (1972): "OR/MS Implementation in Valle, Colombia, S.A.: A Profile of a Developing Region"

This study widens considerably the coverage of settings in our sample, as it looks at OR/MS activities in Colombia, South America. The author is concerned chiefly with the correlates of implementation and diffusion of OR/MS in developing regions. Selection of factors for this study was based both on induction (those factors appearing important in an earlier study) and on deduction (factors which theoretically should be important in a developing country). Factor measurement was accomplished through a mixture of interviews and questionnaires, the respondents being Presidents or General Managers of the companies under study. The dependent variable in this study appears to be the researcher's assessment of whether the factor impacted the OR/MS diffusion and implementation processes.

7. Drake (1973): The Administration of Transportation Modeling Projects

Drake's work focuses on a specific type of project, the application of OR/MS to transportation system modeling efforts. He surveyed a large number of such projects (approx. 50, with 25 in

considerable detail) based in both the U.S. and Europe, and having both private and governmental clients. The factors considered were designed to test a series of hypotheses proposed by the author (the basis for selecting these particular hypotheses appears to be Drake's own work experience). Data were collected through a detailed questionnaire administered by the researcher, and this data was supplemented by his field observations. Drake's intention was to obtain responses from both the model builder and the decision maker (model user), though in a number of cases he was able to speak only to the user. The dependent variable chosen was the decision maker's assessment of the project's usefulness. This focus on the user's view of an implementation effort is both rare and quite important; much of the literature is based on the technician's view of the project, which can be quite different from that of the user (see Dickson & Powers for a discussion of designer/user differences in perception).

8. Lucas (1973): "Behavioral Factors in System Implementation"

Lucas' study differs from most of the others we will consider. He looks at a single sales information system having numerous potential users (salesmen) in a single company, and attempts to find those factors which help differentiate users from non-users. Lucas makes the argument that for purposes of implementation a M.I.S. is equivalent to any other MS/OR project; at a minimum, an information system is a simple model, and frequently information systems contain relatively

sophisticated models. This argument, which we largely accept, should explain our rationale for including this (as well as some other) studies in our sample. Lucas presents a simple descriptive model of factor clusters purported to explain system use, and from this model derives a number of factors to be tested. Factors as well as dependent variables were measured with questionnaires and by examining company records. Indices of six specific types of system usage served as the dependent variables, and factor importance was assessed using stepwise multiple regression to develop usage "prediction" equations. All factors were found to be significant in at least one such equation, but the particular factors included varied across equations; those dealing with attitudes towards and perceptions of the computer system showed a relatively consistent positive relationship with usage, with the results for environmental and personal factors being considerably weaker and less consistent.

9. Manley (1973): "Implementation Attitudes: A Model and a Measurement Methodology"

Manley's work differs in a number of respects from all of the other studies in our sample. First, it focuses neither on the model builder nor the model user, but on the "client", defined as a person impacted by the proposed innovation but having no de jure authority to decide whether to accept and use it or not. The clients in this case were teachers in a public school system presented with a proposal for "optimizing the computation of the supplemental pay for extra-curricular activities." The second major difference was in the dependent variable,

an index predicting the level of client group support of or resistance to the proposed project. This index was derived from the interaction of the clients' assessment of the relative importance of five external factors and their "attitude orientations" toward these factors. The external factors considered were arrived at by boiling down a list of factors culled from the literature to five generic factors. The measurement of these factors represents the third, and probably the most, unique aspect of this study. While being conducted in a real organization with respondents who believed the proposal to be genuine, the study was in fact a controlled experiment; factors were varied systematically by giving different respondents different versions of the proposal. In the experiment Manley tested two of the five external factors -- management support for the project and the amount of the client's time required for implementation -- and found both to result in significant differences in the client's "attitude orientations".

10. Gibson (1973): "A Methodology for Implementation Research"

Gibson offers the only example of a single case study that we have included in our sample. His research was conducted in a New England bank, and was concerned with an effort to implement a translator model which would interface with a regional economic model being developed concurrently. The factors considered in this research were arrived at inductively, being those issues which seemed to have important impacts on the progress of this implementation. Thus, selection of factors was tied directly to the dependent variable. We should note, however, that

there was a fairly long history of "action research" by Gibson and his colleagues at this site, adding credebility to the importance of these factors in this setting. "Measuring" factors was accomplished primarily through unstructured, periodic interviews with key personnel, but supplemented with questionnaires to explore certain issues which arose. This is the only study in our sample where the researchers acted as participant observers and actually attempted to influence the implementation process.

Including Gibson's study in our review of factor research might seem inappropriate, but we have done so for two reasons -- first, the results of the study are couched to an extent in terms of factors; and, his work presents one extreme in methodology for studying implementation, thus adding to the range of our sample. In fairness to the reader we must admit that this is not really a factor study. And, in fairness to Gibson we must point out that this work does not suffer from a number of methodological problems which plague factor research and which we will discuss later in this paper. Indeed, Gibson is one of a very few researchers in this area sensitive to methodological issues.

11. Smith et al. (1973): "Operations Research Effectiveness: An Empirical Study of Fourteen Project Groups"

Our next study also took place in a single organization, but it looked at fourteen separate projects within this organization. Smith et al. attempted to find the factors which contributed to the effectiveness of project teams consisting of user, systems, and OR personnel. The

factors considered included a number of predefined items -- e.g., user demographics -- plus those factors reported by team members to have been important contributors to or detractors from their effort. Factors were measured using a questionnaire administered by the researchers. Two dependent variables were employed. For testing the predefined factors, the average group effectiveness rating as reported by the team members served as the dependent variable, while for the elicited factors, the relative importance rating given that factor by the respondents was used.

12. Carter et al. (1973): "A Study of Critical Factors in Management Information Systems for U.S. Air Force"

The research of Carter et al. is presented to us at a somewhat earlier stage than the other studies we have considered. The long term goals of this research are the identification of those factors critical to MIS implementation success, the development of instruments to measure the status of these factors, and, eventually, the development of a model for predicting implementation success. The phase I results presented relate primarily to the first of these three goals. An initial set of interviews with systems and general management professionals was used to generate a series of reconstructed implementation case histories. The researchers "content analyzed" these interviews to abstract a list of critical factors. A subset of this list was tested in a national survey, in which respondents were asked to rank the relative importance of the fourteen factors presented. Thus, at this stage of the research, the average ranking (in terms of its overall importance) received by a

factor serves as the dependent variable. We should note that this project is considerably more sophisticated, both in terms of scope and method, than much of the other factor research; the full project involves several recursive steps over a period of a few years.

13. Bean et al. (1973): "Structural and Behavioral Correlates of the Implementation of Formal OR/MS Projects: Success and Failure in U.S. Business Organizations"

This is the most ambitious study (at least in terms of sample size) included in our sample. It was aimed primarily at the structural and organizational factors affecting implementation. One hundred and eight companies covering 12 industry sectors were explored, and approximately 10-15 projects in each company were included in the sample. Factors were pre-selected, and were measured through structured interviews with the head of the OR/MS activity in each company. Two dependent variables were considered; the percentage of projects worked on which were successfully implemented, and the OR/MS activity manager's overall assessment of his group's success (an index composed of a number of his responses). One particularly important finding of this study is the effect of the OR/MS activity's "stage in the life cycle" on both which factors are important and the overall level of OR/MS success.

14. Schultz & Slevin (1973): "Implementation and Organizational Validity: An Empirical Investigation"

The final study in our sample is a report of Schultz and Slevin's efforts to develop an easily usable instrument for studying

implementation. The authors contend that the relative lack of research on implementation is due, at least in part, to a lack of research tools; hence their effort to develop a tool that would be generally applicable for such research. The instrument and this study focus on individual attitudes as they relate to a particular model and its implementation. An extensive list of potential variables was assembled from the literature, and a pilot version of the questionnaire was administered to a class of M.B.A. students. The responses were factor analyzed, and a modified questionnaire, based on these extracted factors was used in the field test. This latter test involved 94 sales and marketing personnel in a single company, responding to questions concerning a specific model under development for their department. Questionnaire items were of two types -- semantic differential concept factors and specific items in a Likert-type format. Five of these latter items, dealing with expectations for the model's use and worth, served as dependent variables.

This section has reviewed the issues of setting, methodology, and dependent variable in the fourteen studies that comprise our sample of factor research. Table I provides a summary of this material. As can be seen, the studies cover a wide range. Beyond the questions of setting and method, the issue of focus has been raised. Some studies were concerned with the factors affecting specific implementations, others focused on factors influencing OR/MS group effectiveness, while still others examined the issues of growth and diffusion of the OR/MS approach.

Table I: Highlights of the Fourteen Studies

	Setting	Factor Selection	Measurement of Factors	Dependent Variable Employed	Notes
1. McKinsey & Co. (1968)	U.S. & Europe, 13 industries, 36 companies	Inductive	extensive interviews of staff & line executives	subjective ranking of overall computer achievement	importance of management support and involvement first shown
2. Evan & Black (1967)	104 projects, technical & non-technical in U.S. cos.	Deductive	self administered questionnaire	proposal largely implemented by line management	discriminant analysis of difference between successful and unsuccessful proposals for innovation
3. Rubenstein et al. (1967)	U.S. industrial organizations	Inductive, from their earlier exploration	in depth interviews	estimate of extent to which OR/MS proposals and programs were implemented	focus on factors affecting OR/MS group effectiveness and growth
4. Harvey (1970)	31 clients of author's consulting firm	Inductive, based on experience in projects	ranking of companies by consultants	acceptance and implementation of consultants' recommendations	grounded in belief that management support and participation were not only important factors
5. Dickson & Powers (1971)	10 cos. in Minneapolis/ St. Paul area	Deductive, common sense plus experts	interviews of major project participants	time, cost, user satisfaction, and impact on computer operations	
6. Vertinsky (1972)	45 companies in Colombia, S.A.	Mixed -- case based + theory	interviews & questionnaire to Pres. or General Mgr.	researcher's assessment of factor importance	implementation and diffusion in a developing region

Table I: Highlights of the Fourteen Studies (continued)

	Setting	Factor Selection	Measurement of Factors	Dependent Variable Employed	Notes
7. Drake (1973)	transportation modeling, US & Europe, public and private	Deductive -- past experience	researcher administered questionnaire + observations	decision maker's assessment of project usefulness	explicit focus on decision maker's view of project
8. Lucas (1973)	1 system in 1 co. with many users	Deductive -- simple model	questionnaires & company records	indices of specific types of system usage	argument for equivalence of MS & MIS from implementation view
9. Manley (1973)	teachers in a public school system	Deductive -- large lit. rev.	experimental variation	prediction of client group support or resistance	interaction of external factors and client attitudes
10. Gibson (1973)	single case in N.E. bank	Inductive	unstructured interview + questionnaire	propensity to implement; attitudes favorable to usage	participant observation; longitudinal case study
11. Smith et al. (1973)	14 project grps. in 1 mfg. co.	Mixed	interview administration of quest'aire	avg. effectiveness ratings given teams by members	focus on groups incl. user, OR, & systems personnel
12. Carter et al. (1973)	nationwide expert panel	Inductive - content analysis	questionnaire	ranking given to each factor	phase I of multi-phased study
13. Bean et al. (1973)	10-15 projects in each of 108 companies	Deductive	structured interview w/ OR manager	rate of implem'n; OR mgr's perception of success	modifying effect of stage in life cycle of OR/MS activity
14. Schultz & Slevin (1973)	potential users of 1 model in 1 org.	Mixed	questionnaire Likert & semantic differ'l	5 items on expectations for model usage & worth	attempt to develop a generally usable instrument

All of these are legitimate areas for implementation research; all are representative of some part of the factor research that has been conducted. Thus, all were included in this review. In the next section we turn to the results of these studies.

3. Results of the Factor Studies

3.1. A structure of implementation factors.

The fourteen studies we have reviewed present us with 140 separate, identifiable factors. Considering all of these factors on an individual basis would be both time consuming and dull. Thus, we need some sort of structure within which to organize these factors. In reviewing the literature, and in attempting to think about the various possible influences on implementation outcomes, we have found ten major clusters of variables. These are:

1. Symptoms, actions, and specific behaviors -- identifiable actions taken by the user, designer, or management which either affect or are in some way symptomatic of the implementation effort;
2. Internal ecology -- characteristics of the organization, its structure, and the people who comprise it;
3. Model characteristics -- characteristics of the physical and conceptual solutions to the problem;
4. Problem characteristics -- the nature of the problem and its criticality to the organization;

5. Extra-organizational environment -- characteristics of the external environment facing the organization;
6. Implementation process characteristics -- methods used to move through the stages of system development, communication patterns, role structures, etc.;
7. Perceptions -- perceptions of tasks, goals, and the impact of the proposed solution held by those involved in or affected by the implementation effort;
8. Expressed attitudes -- attitudes of involved and effected personnel towards technology, the problem, and one another;
9. Underlying attitudes and motives -- more basic outlooks and desires of involved and effected personnel; and
10. Organization history -- past actions of the organization which can impact its current ability to deal with innovation.

Each of these major clusters has been divided into sub-clusters based on the particular factors explored in the fourteen studies of our sample (see Appendix I). We make no claim for the completeness of the sub-clusters; these are based solely on the 140 identified factors. We do suggest, however, that the ten major groups cover the range of potential factors adequately.

3.2. Summary of results.

Appendix I presents a matrix of the 140 factors, grouped in accord with the structure we have presented above, showing the results of the fourteen studies we have considered. Perhaps the most striking characteristic of this matrix is its sparseness. Fully 102 (73%) of the factors are reported in only one of the fourteen studies. An additional 23 (16%) are reported in two studies, and 12 (9%) in three. Of the remaining three factors, two -- "well defined measurable objectives" and "complexity of techniques and models" -- are considered in four of the research efforts reviewed, and the final one -- "management support" -- sees daylight five times. Thus, from the start we must realize that we are not looking at issues widely tested in a variety of settings.

Next, we note the concentration of both factors and observations in the first few of our ten factor groups. Fully 50% of the factors and 58% of the factor observations fall into the first two classes -- symptoms and actions, and characteristics of the internal organizational environment. This translates to 28 of the 38 (or 74%) factors with multiple observations falling into the first two classes, with 87% (33) falling in the first four of ten groups. We will return to this issue in the next section when we consider more carefully the types of factors that have been studied.

We have already pointed to the very low degree of overlap among factors considered in these fourteen studies. The importance of

this lack of comparability is emphasized when we consider those factors where multiple measures have been taken. In a significant proportion of such cases there is a lack of concordance among the findings. Consider, for example, the factor "well defined, measurable objectives for the system" (I.C.10). Four studies included this factor; in three it was found to be important, while in the fourth (Dickson & Powers) it did not relate significantly to any of the four dependent variables. Numerous similar examples can be found in the tables of Appendix I.

A partial explanation for this finding is the difference in dependent variables among the studies. This can be seen most clearly in the results of the Dickson & Powers and Bean et al. studies. In both of these efforts multiple dependent variables were employed -- four in the former and two in the latter -- and the authors report the correlations of each dependent variable with the factors. Thirty percent (12 out of 40) of the factors reported in the Bean et al. study show different results depending on which dependent variable -- percent of initiated projects actually implemented or overall rating of the OR/MS group's success -- is used. Of course, the differences for any given factor are only between significance in one direction and no significant relationship. However, in the Dickson & Powers study the picture is somewhat more depressing; no factor significantly related (at the 10% level) to more than one of the dependent variables affects all of the dependent variables it is significantly related to in the same direction.

While the differences in dependent variables employed provide

a fairly convincing explanation for the apparent contradictions among certain of the results, there are other potential explanations which we should explore. One such possibility is a lack of validity in the factor measures; i.e., the 'instruments' used do not measure what they purport to. The results reported in the fourteen studies do not give us much opportunity to test this hypothesis, but there is one indication that this might be the case. Schultz & Slevin use a combination of semantic differential scales and Likert-type questions in their work, and for a few factors these two measures overlap. For one, "expected changes in the communication system and interpersonal relations", the results differ for the two ways of measuring the factor. While this is hardly conclusive proof of poor instrument validity throughout the factor studies, it does suggest that the problem may exist (particularly when we consider that many studies relies on the researcher's observations for 'factor measurement', and that there is no evidence to suggest that any instrument was ever used more than once).*

The third potential explanation is the issue of contingency, or lack of comparable conditions. Implicit in the factor approach is the assumption that factors are universal -- management involvement is always good, or the OR group's selecting the projects to be worked on is always bad. We contend that this is an unwarranted assumption, that the importance of a given factor will vary from situation to situation.

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*Keen (1974) takes a closer look at the instruments used in factor studies and the question of their validity.

Bean et al. present some evidence which supports this position. They analyze their data both in aggregate and broken down to control for the stage in the life cycle of the organization's OR/MS activity, and find differences in factor significance across the stages. This is only one of many possible contingencies, but it points up the need to identify the relevant contingencies before accepting the results of a given study.

Finally, in considering explanations for particular results, we should not ignore the possibility of spurious correlation or non-correlation. Turning again to Bean et al., we observe a most unusual finding: the performance of post implementation evaluations is significantly positively related to the percent of initiated projects which are implemented, but is unrelated to the overall rating of the OR/MS group's success. It is indeed difficult to imagine why performing post project audits should affect the rate at which projects are accepted. At best we might believe that such an administrative procedure is related to other organizational practices which in turn impact implementation rate, but accepting this result as it stands requires just too great a leap of faith.

We can draw certain conclusions from our brief look at the factor study results. Though many factors have been studied there are few general guidelines emerging from this line of research. In part this is due to a lack of replication of tests, and in part to the fact that little of what has been reported prior to a given study seems to find its way into the design of that study. This is further compounded by the

use of different instruments and dependent variables in each study, and by a failure to identify the contingencies that are important in any given situation. All in all, we can judge this line of research as having contributed less than it might have so far. We would also suggest that the factor approach, lacking in theory, inter-study comparability and to a great extent, direction, can never produce more than fragmented findings of the type it has so far. Until there is an effort to build "maps" which can integrate results by focusing on key contingencies, we cannot progress in this line of research (see Keen, 1974, for further comments on this issue).

4. A Deeper Look at the Factor Paradigm

4.1. Relationships among the factors.

In the previous section we presented ten groups into which we classed the 140 factors. Now we will explore these classes more carefully, attempting to uncover relationships which exist among the different factor classes. We can think about factors as being arrayed along a dimension of visibility to the outside observer. At one extreme would be those factors which are totally overt, accessible to even the casual observer; and, at the other extreme, those which are almost completely hidden, inaccessible to all but those with a considerable knowledge of the particular organization, its operations, and its background. We suggest that the ten factor classes presented earlier form, roughly, such a continuum, and can be divided into a few groups. At the overt extreme

are the first two classes -- symptoms, actions, and specific behaviors, and characteristics of the internal organizational ecology; the factors in these two groups being relatively easy to observe in most organizations. At the opposite extreme are categories IX and X -- underlying attitudes and motivations, and aspects of the organization's history. Clearly, these factors are largely hidden from all but the most persistent and resourceful observers. In between are categories III through VIII. These might be divided into two or three groups, but it is not critical to do so for our purposes. We have arranged them in an order we believe approximates the degree to which they are hidden from the observer -- model characteristics being most overt and expressed attitudes most covert.

Keeping this overt-hidden dimension in mind, lets look at the factors from another angle. Implementation is a process of change. As a process, it accepts certain inputs and produces certain outputs. The critical output of such a change process is the desired change; in the case of MS implementation, the model or system and the requisite changes in behavior to operate with the new system. The inputs to the process include the attitudes and actions of the individuals involved, their perceptions, the problem they are addressing and the technology they attack it with, and the environment in which they are operating. In other words, many of the factors mentioned in the factor studies are inputs to the implementation process. Others, particularly those listed under classes I (symptoms, actions, and specific behaviors) and

Table II

Distribution of Research Effort by Factor Class*

	McKinsey & Co.	Evan & Black	Rubenstein et al.	Harvey	Dickson & Powers	Vertinsky	Drake	Lucas	Manley	Gibson	Smith et al.	Carter et al.	Bean et al.	Schultz & Slevin	Overall Proportion
Symptom & Actions	.75	.09	.42	.27	.31	.10	.13	-	.10	-	.18	.38	.37	.13	(45) .23
Internal Ecology	.25	.55	.42	.20	.56	.20	.33	.67	-	.22	.36	.15	.57	.07	(69) .35
Model Chars.	-	.09	-	.07	.06	-	.20	-	.10	-	-	.08	-	.07	(9) .05
Problem Chars.	-	.09	-	.13	-	-	-	-	.20	.11	.07	-	.03	.13	(11) .06
Extra-Org'l Environ.	-	.09	-	-	-	.30	-	-	-	.22	-	-	-	-	(6) .03
Implement. Process	-	-	-	-	.06	-	.27	-	-	-	.29	.08	-	-	(14) .07
Perceptions	-	-	.08	.13	-	-	-	.33	.10	.11	.07	-	-	.40	(16) .08
Attitudes	-	-	.08	.07	-	-	.07	-	-	.11	.04	.23	-	.20	(11) .06
Motives	-	.09	-	.13	-	.40	-	-	.50	.11	-	.08	-	-	(14) .07
History	-	-	-	-	-	-	-	-	-	.11	-	-	.03	-	(2) .01
Proportion of Total	(4) .02	(11) .06	(12) .06	(15) .08	(16) .08	(10) .05	(15) .08	(9) .05	(10) .05	(9) .05	(28) .14	(13) .07	(30) .15	(15) .08	(197) 1.0

*By research effort we mean the inclusion of a factor in a study, or to be more presise, the reporting of a factor in the write-up of a study. Thus, the numbers in the body of this table are the percentages of the factors in the particular study (column) falling into that class (row). The final column presents these same percentage for the fourteen studies taken as a group, and the final row shows the proportion of factor observations attributable to each study. The paranthesized

Table II (continued)

numbers in the final row and column represent, respectively, the number of factors included in the study, and the number of observations (i.e., inclusions in a study) of the factors in that class.

VI (implementation process characteristics) are an indication of the process that is taking place; they are symptoms of the on-going process. We should note that neither of these types of factors truly represents the actual process of change. On the one hand we have the 'fuel' for the process; on the other, certain side effects of its occurring. But, the former group does not represent the cause of change, nor the latter its output.

Returning now to our overt-hidden dimension, we can see how the factors fit together. At the overt extreme of the spectrum we have the bulk of the symptoms of change plus one type of input to the process. The remainder of the inputs are arrayed along the scale towards the hidden end.

When we look again at the fourteen studies we find a disproportionate amount of research effort going into the overt end of the scale (Table II). The first two factor classes represent a total of 58% of the factor observations (23% and 35% respectively). None of the remaining eight classes received more than 8% of the total factor observations. Looking at the studies individually we see that all fourteen consider some factors from one of the two first groups. In

addition, in all but three of the studies the class receiving the most attention was one of the first two. No other factor class comes near these first two in terms of attention received.

We have no a priori reason to believe that overt behaviors or internal organizational ecology are more important than other factors in determining implementation outcomes. In fact, a case can be made which suggests just the opposite; attitudes, perceptions, motives, and organizational history may well be the underlying causes of some of the more overt factors, specific actions and behaviors or the structuring of the internal organization, for example. Why, then, do we find the preponderance of research effort being directed towards the most overt factors? Perhaps the most plausible explanation is that suggested by Keen. The more overt the factor, the easier it is for a researcher to measure it. Having little or no theory to guide them in their selection of factors, researchers have chosen those factors which were most readily accessible.

4.2. Further work with the factor paradigm?

There has been a trend very recently in some circles to move away from the factor approach to implementation research (Gibson, 1973, Lucas & Plimpton, 1972, Sorensen & Zand, 1973, and Urban, 1974, are all examples). The reason for this movement is a growing recognition of some serious shortcomings of the factor paradigm. Most important among these failings are the absence of any theoretical base supporting most

factor studies, a failure to look at implementation as a process extending over time, and a tendency to focus on a few variables one at a time, thus ignoring other important variables and interactions among variables.

We will turn now to one recent study which was undertaken to meet the objections cited above (Miller, 1974). This study is an extension of the work of Gibson and his colleagues, and took place at the same field site. Thus, the author had a considerable amount of backgroung knowledge, both substantive and methodological, to draw upon. Miller suggests that in order to understand implementation it will be necessary "to conduct longitudinal studies of the implementation process in its manifold complexity as it unfolds and develops over time" (p. 13). His aim is to understand the behaviors of managers and model builders which together bring about the outcomes of an implementation effort. To this end, he adopts a simple model for viewing such behavior. The model proposes that three sub-systems (or variable classes) determine behavior -- the individual, the social, and the organizational sub-systems. For each of these sub-systems Miller defines certain variables and measures assumed to be the right ones for consideration in an attempt to understand implementation. Over a relatively long period the researcher then observed an implementation effort (the N.E. bank translator model mentioned in our discussion of Gibson's work) and collected a considerable quantity of data, including quantitative measures of the sub-system indicators he had defined.

And, in general, he found that these variables had some impact on the implementation process.

Miller undertook this research effort in answer to certain shortcomings he found in the factor approach, and in certain areas he has successfully addressed problems which characterize previous factor studies. He recognizes implementation as a process of change. Hence, he has chosen a dependent variable more appropriate to such an effort than the simple definitions of success frequently used in factor studies; and, he has looked at the change effort over a sufficiently long period of time to get some real understanding of what is going on. However, in many ways his work is really a factor study, and he falls into some of the traps of previous factor researchers.

By carefully examining the problems which Miller's work raises, we can begin to understand why the factor paradigm is an inadequate model for implementation research. First, consider the variables studied in this effort. Table III presents these variables, where they fit in the structure of factors presented earlier, and an indication of whether or not they were included in one (or more) of the fourteen studies we have reviewed. Three points are immediately apparent when we look at the table. First, Miller's factors fall largely (five out of seven) in a single factor class, the internal organizational environment. Second, coverage is strongly biased towards the more overt factors, with five factors in class II and one in class I. And, third, the factors studied are by and large new ones, not covered in

Table III

Factors in Miller's Study of Implementation

Factor	Cluster, sub-cluster, and factor number	No. of other studies including factor
1. cognitive style of users & model builders	II.G.41	1
2. builder/user personality style match	II.F	0
3. builder/user status or rank differences	II.F	0
4. belief or ideological systems of builder & user	IX & IX.B	0-builder; 1-user
5. builder & user task environments -- explicitness of task definitions, constraints imposed, & nature of tasks	II	0
6. builder & user reward structures	II	0
7. supervisory support for assigned roles	I.A	covered in part by I.A.2&3

any of the fourteen studies; two of the seven factors being partially addressed in other studies, and only one factor that truly overlaps those in the previous studies.

What, we might ask, are the implications of these results? Let us start with the third, the introduction of new factors. We observed earlier that a very large portion of the 140 factors in Appendix I were addressed in only one study. Now we add one more study including seven factors and our total jumps to 146. The problem this

suggests is that the number of potentially important factors is virtually uncountable. So many variables could affect an implementation effort that we could go on forever adding new factors to our list.

Turning to the issue of coverage of the range of factors, we can see that Miller fell into the trap of most previous factor researchers. He opted to measure a certain subset of factors, and these were concentrated at the overt end of the factor spectrum. True, he found these seven variables to be significant, but he can say nothing about the hundreds of factors he did not test. This, we believe, is one of the major weaknesses of the factor paradigm; you can only get out what you put in. And, this is true whether the factors to be measured are picked at random, selected on the basis of ease of measurement, or based on some theory of behavior. The initial selection determines the maximum that you can learn. We will discuss this point further in the next, and final, section of this paper.

5. Summary of Problems with the Factor Model

Factor studies of implementation have given us some useful knowledge about implementation. They have shown that there are a myriad of factors which can, and at least sometimes, do affect the progress of an implementation effort. However, we contend that this approach has a number of flaws serious enough to cause us to doubt its further usefulness as a paradigm for research on implementation.

The first of these problems stems from the almost limitless

number of potentially relevant factors. The researcher, having only a limited amount of time, must of necessity limit his investigation to a small subset of these factors. In the absence of any well defined theory of implementation, the selection of factors for consideration is left largely to the individual researcher's biases; and, as we have seen, such selection is not likely to provide a representative sample of factors. We have also noted that the same result can obtain if we move to the other extreme. Tightly defined theories of implementation behavior are likely to focus on only a few factors. Thus, using such theories as guides to the selection of factors for study yields the same result as using no theory at all; careful attention to a small number of factors at the expense of ignoring other, likely equally or more important, factors. As we stated earlier, you can only find out what you go in looking for.

The second major defficiency of the factor model as a research vehicle is its inherently static view of the world. Typically, factors are measured at a single point in time and the results are assumed to capture the essence of that implementation effort. If we review the factors listed in Appendix I, we find that all of them deal with either inputs to the implementation process or side effects of the process. None are truly concerned with the dynamics of the on-going process. Yet, implementation is a process, taking place over a considerable span of time, and any meaningful understanding of implementation must stem from a recognition of its inherently dynamic nature.

Our third complaint concerns the implicit assumption of many factor researchers that factors are absolutes -- a given condition is always good or always bad. A more realistic view is one which considers contingencies or factor interactions. The effect of a factor in a given situation depends greatly on the other factors present in that situation. There is no inherent reason (other than the complexity of analysis and the need for larger quantities of data) why factor studies cannot consider such interactions; few researchers, however, have done so.

The fourth, and final, fault we will raise is the failure to focus on the management of the implementation process. The concern has been with measuring, classifying conditions as favorable or unfavorable to implementation outcomes. This orientation is understandable given the static world view embodied in this paradigm and the nature of the factors that have been considered. Practitioners, however, are more interested in managing the process, making an implementation effort successful, than in being able to explain why it failed.

In sum, we can state four necessary characteristics of an improved implementation research methodology. First, it should be grounded in a sort of "mid-range" theory; going neither to the extreme of no theory at all, nor to the that of a theory so confining that much important evidence is ignored. Next, it should focus on dynamics, the process aspects of implementation. Third, it must recognize the existence of contingencies and interactions among factors, and it should aim towards developing maps of the major and critical contingencies

likely to arise in given situations. Finally, if it is to be of any real use, it must be oriented towards the management of the process, and must include appropriate control points for managers' and practitioners' use.*

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*See Keen (1974) for a more thorough discussion of the desiderata of a methodology for implementation research.

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Appendix I: Findings of the Factor Studies

Key

Since the studies vary in what they report, it is not possible to adopt a uniform coding for all of the study results. Thus, each of the studies is marked in the following table in the manner which fits it most logically.

Where applicable factors are coded as follows:

+ -- significant (by whatever test was used in the particular study) positive effect of the factor on the dependent variable

\- -- significant negative effect of the factor on the dependent variable

0 -- no significant effect of the factor on the dependent variable found

Exceptions to the above scheme are:

1. Rubenstein et al. -- a '✓' indicates those variables found to be favorable to implementation success.

2. Harvey -- a '✓' indicates those factors suggested to be important.

3. Dickson & Powers -- factors marked with the direction (+ or -) for each of the dependent variables they were found to affect significantly (T -- time, B -- budget, U -- user satisfaction, C -- computer operations), or with a '0' if no dependent variable was found to be significantly affected.

4. Vertinsky -- a '✓' indicates those factors found to be important.

5. Lucas -- a '✓' indicates that the factor entered into at least one of the 'prediction equations' -- N.B. all factors tested entered into at least one equation.

6. Manley -- five external factors marked according to their relative importance as determined by the study (1 = most important); motivational factors (attitude orientations towards the external factors) marked with a '✓'.

7. Gibson -- a '✓' indicates those variables emerging as important in the case studied.

8. Smith et al. -- quantitatively measured factors indicated with the standard +,-, or 0; qualitatively assessed factors marked for their relative (to one another) importance as determined in the study (H = high, M = medium, L = low).

9. Carter et al. -- ranking of the relative importance assigned the factors included in the nationwide study (H, M, or L).

10. Bean et al. -- marked as +,-, or 0 for each dependent variable separately: implementation rate/overall success.

11. Schultz & Slevin -- standard +,-, or 0 marking except in cases where the two ways of measuring a factor yielded different results; then marked as semantic differential finding/Likert factor finding.
    N.B. factors included in the table are the concepts used in the sematic differential instrument and the derived factors composed of aggregates of items from the Likert-type instrument.

APPENDIX I

FACTOR CLUSTER, SUB-CLUSTER & FACTOR	MCKINSEY & CO	EVAN & BLACK	RUBENSTEIN ET AL.	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL.	CARTER ET AL.	BEAN ET AL.	SCHULTZ & SLEVIN
I SYMPTOMS, ACTIONS & SPECIFIC BEAHVIORS														
A MANAGEMENT SUPPORT AND INVOLVEMENT														
1 Top management selects the projects													o/o	
2 Mgt supports MS approach & technical group			✓						1		H		+/+	+
3 Top management interested and involved in projects											L		+/+	
4 Operating management participation in projects					IH							M		
B USER INVOLVEMENT														
5 Substantive communication between modeller & user		+					0							
6 Formalized user-OR liason role													o/o	
7 Client selects projects													o/o	
8 Cooperation & participation of user personnel	+										M			+
C SPECIFICIATION OF OBJECTIVES														
9 Cost/benefit analysis performed												M	o/o	
10 Well defined, measurable system objectives				✓	0						M	H		
11 Mgt's information needs are identified												H		
12 Org. objectives identified, projects relevant	+		✓									M		
D PROJECT ADMINISTRATION														
13 Formal project planning	+						0							
14 Use of documentation standards					T+									
15 Formal project progress reports					0									
16 Post project evaluation													+/o	
E DISCRETION GIVEN TO OR GROUP														
17 Technical group generates project ideas					U-								o/-	

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	E(cond) DISCRETION GIVEN TO OR GROUP	MCKINSEY & CO	EVAN & BLACK	RUBENSTEIN ET AL.	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL.	CARTER ET AL.	BEAN ET AL.	SCHULTZ & SLEVIN
18	Technical group selects projects			✓								L		o/-	
19	Freedom given group to gather data, implement results			✓	✓										
20	OR/MS group ability to influence organization			✓											
F	OR/MS GROUP LEADER ACTIVITIES														
21	Orientation towards profession rather than organization													-/o	
22	Proportion of leader's time spent implementing													+/+	
G	MANAGEMENT ORIENTATION TO INNOVATION														
23	Mgt avoids being overcautious				✓										
24	Mgt does not punish failure excessively				✓										
25	Mgt displays confidence in interactive environments						✓								
II	INTERNAL ECOLOGY														
A	FORMAL STRUCTURE														
1	Degree of bureaucratization							-							
2	Organization size (revenue, employees)		0											-/o	
3	Degree of centralization		0				✓							o/+	
4	Functional location of OR/MS group			✓										o/o	
5	Level in hierarchy of OR/MS group or group leader					T- C+								+/+	
6	Formality (inc. formal charter)		+											+/+	
B	OR/MS GROUP STRUCTURE														
7	Life cycle stage (age) of group			✓										-/o	
8	Absolute size of group					†						0		o/o	
9	Relative (to org. size) size of group													+/+	
10	Centralization of group & activities					$\sigma^2=0$						L		o/o	

†≡ T-;B-;U+

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B(cond)OR/MS GROUP STRUCTURE	MCKINSEY & CO	EVAN & BLACK	RUBENSTEIN ET AL.	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL.	CARTER ET AL.	BEAN ET AL.	SCHULTZ & SLEVIN
11 Formality of group operations													+/0	
C TECHNICAL COMPETENCE, SKILLS & EXPERIENCE														
12 Modeller expertise in subject area							+							
13 Low turnover of project personnel					U+		+				L			
14 OR group involved in a mix of projects (size, length)													+/0	
15 Variety of techniques employed													+/0	
16 Variety of functional areas as clients													+/0	
17 Technical competence of OR/MS group members			✓								H M	M		
18 Project personnel have systems experience					0									
19 Staff professionalization (proportion)		+												
20 Frequency of innovative ideas		0												
D OR/MS GROUP ORGANIZATIONAL & SOCIAL SKILLS														
21 Communication ability & design team												H		
22 OR member human relations skill											M			
23 Leadership skill in project group											L			
24 Organizational competence; ability to work w/mgrs.			✓	✓										+
E RESOURCES/SLACK														
25 Organizational profitability													+/0	
26 OR/MS group budget													-/0	
27 Availability of sufficient resources			✓											
28 Hardware investment (relative to sales)					0									
F OR-USER SIMILARITY & CONTACT														
29 Proximity of decision makers to modellers; contact	+						0							
30 Similarity of d-m & modeller background							+							
31 Project team includes both MIS & user personnel					0									

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II(cond) INTERNAL ECOLOGY	MCKINSEY & CO	EVAN & BLACK	RUBENSTEIN ET AL.	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL.	CARTER ET AL.	BEAN ET AL.	SCHULTZ & SLEVIN
G USER DEMOGRAPHICS														
32 Mgt experience with sophisticated techniques				✓										
33 Mgt decision making fact based, viewed as trade-offs				✓										
34 Organizational cooptation of modernizing personnel						✓								
35 Line mgt professionalization		-												
36 User load (e.g. # of accts.)								✓						
37 User experience in job, position territory								✓						
38 User's past level of task performance								✓						
39 User's age								✓						
40 User's educational level								✓						
41 User's "decision style" attention to details								✓						
H OR/MS GROUP MEMBER DEMOGRAPHICS														
42 Age of leader & group members											0		%	
43 Group member years with the company					U+						0			
44 Formal educational level of personnel					T- C+						0		%	
I SOCIAL SYSTEM														
45 Relative power of different organizational components										✓				
46 Stability of social & decision making structures										✓				
III MODEL CHARACTERISTICS														
A TECHNIQUES EMPLOYED														
1 Complexity of techniques and models							?		5			L		+
2 Use of high level languages					T+		-							

III(cond) MODEL CHARACTERISTICS	MCKINSEY & CO	EVAN & BLACK	RUBENSTEIN ET AL.	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL.	CARTER ET AL.	BEAN ET AL.	SCHULTZ & SLEVIN
B MODEL COMPLETENESS/ COMPREHENSIVENESS														
3 Inclusion of social & political considerations in model							-							
4 Proposal/solution quality		+												
5 Solution reflects sensitivity to motivations & priorities				✓										
IV CHARACTERISTICS OF THE PROBLEM														
A URGENCY														
1 Urgency to company and to the management		+							2					+
2 Importance of project to user											L			+
B PROBLEM STRUCTURE & NOVELTY														
3 Problem not addressed by conventional means				✓										
4 Well defined scope -- not too broad nor too narrow				✓										
5 Availability of data and information											H		+/+	
6 Level of client involvement req for implementation									4					
7 Nature of decision process for problem -- rational vs. opportunistic										✓				
V EXTRA-ORGANIZATIONAL ENVIRONMENT														
A COMPETITIVE ENVIRONMENT														
1 Market position and competitor's actions						✓				✓				
2 Strength of organization's competitve position		+												
B GOVERNMENT														
3 Governmental activities and pressures						✓				✓				

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		MCKINSEY & CO	EVAN & BLACK	RUBENSTEIN ET AL.	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL.	CARTER ET AL.	BEAN ET AL.	SCHULTZ & SLEVIN
V	EXTRA-ORGANIZATIONAL ENVIRONMENT (cond)														
C	TECHNOLOGY														
4	Type of product and technological environment						✓								
VI	IMPLEMENTATION PROCESS CHARACTERISTICS														
A	TIME														
1	Size and length of project							-							
2	Adequate time frame allowed for system development												L		
B	ROLES														
3	Recognition of manager-analyst role differences							+							
4	Group responsibilities & goals well defined											H			
5	Separation of analyst & programmer roles					T+ U-									
C	COMMUNICATION														
6	Methods used, #of, & use made of external communication											0			
7	No. of external contacts made by perceived project leader											+			
8	Communications, cooperation & info. received from user											M			
9	Time spent by project group in internal communication											0			
10	Internal contacts by group members w/user representative											+			
11	Positve quality of internal comm. (friendly, open, etc.)											H +			
12	Time spent in internal comm. by perceived leader											-			
D	CONFLICT RESOLUTION														
13	Conflict resolution through confrontation							+							
E	EVOLUTION														
14	Evolutionary approach to modeling taken							+							

APPENDIX I

VII PERCEPTIONS	MCKINSEY & CO	EVAN & BLACK	RUBENSTEIN ET AL.	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL.	CARTER ET AL.	BEAN ET AL.	SCHULTZ & SLEVIN
A TASK PERCEPTIONS														
1 Perceived task sophistication											0			
2 MS team recognizes operational realities & potential difficulty				✓										
3 Expected effect of model on mgr's job performance & visibility														+
4 User's perception of computer potential in clerical & mgr task								✓						
5 Mgr's perception of task nature e.g. rational, programmable										✓				
B GOALS AND PRIORITIES														
6 Group member recognition of project priority											L			
7 Mgt sees congruence between study & organizational objectives				✓										
8 Model will make goals clearer, more congruent & attainable														+
9 Degree of product relevancy to client's organizational role									3					
C OR/MS GROUP COMPETENCE														
10 OR/MS group reputation for success			✓											
D SYSTEMIC CHANGE														
11 User expectation of change in executive decision making														+
12 Expected changes in communication systems & interpersonal relations														+/o
13 User expectation of effects on relations w/others														+
14 Exepcted changes in structure and coworkers														0
E THE MODEL/SOLUTION														
15 User's perception of output quality								✓						
F MANAGEMENT ATTITUDES, CAPABILITIES AND DESIRES														
16 User's perception of degree of mgt support of computer use								✓						

APPENDIX 1

VIII EXPRESSED ATTITUDES	McKINSEY & CO	EVAN & BLACK	RUBENSTEIN ET AL	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL	CARTER ET AL	BEAN ET AL	SCHULTZ & SLEVIN
A MANAGEMENT & CLIENT ATTITUDES TOWARD TECHNOLOGY														
1 Receptivity or opposition OR/MS			✓											
2 Belief in advance that technique & MS approach could work				✓										+
3 Attitude towards various types of computer usage										✓				
B ATTITUDES TOWARDS TECHNICAL GROUPS														
4 User attitudes twoards design team members												L		
5 User confidence in model developers														+
C MANAGEMENT/CLIENT ATTITUDES TOWARDS SPECIFIC PROJECT														
6 Decision maker's desire for useful results							?							
7 Mgt/client overall attitude toward model, project												H		+
D TECHNICAL GROUP ATTITUDES														
8 Towards user department												L		
9 Technical group members are Interested & committed											H			
IX UNDERLYING ATTITUDES & MOTIVES														
A ATTITUDE TOWARD CHANGE														
1 Mgt & employee resistance or receptivity to change		0				✓						L		
2 Mgt attitude towards risk and uncertainty						✓								
B MANAGEMENT CULTURE & WORLD VIEW														
3 Future orientation & management				✓										
4 Mgt sensitivity to environment & environmental changes				✓										
5 Managerial value system -- continuous vs discontinuous						✓								
6 Manager's group identification										✓				
7 Mgt curiosity & search drive						✓								

APPENDIX I

		McKINSEY & CO	VAN & BLACK	RUBENSTEIN ET AL	HARVEY	DICKSON & POWERS	VERTINSKY	DRAKE	LUCAS	MANLEY	GIBSON	SMITH ET AL	CARTER ET AL	BEAN ET AL	SCHULTZ & SLEVIN
C	AFFECTED USER MOTIVATIONS														
8	Client attitude orientation to CEO support of project									✓					
9	Client attitude orientation to project urgency									✓					
10	Client attitude orientation to perceived relevancy of projects to his organizational role									✓					
11	Client attitude orientation to involvement in implementation									✓					
12	Client attitude orientation to project complexity									✓					
X	ORGANIZATION HISTORY														
A	OR/MS INNOVATIVENESS														
1	Early start to OR/MS activities (relative to study)													%	
B	ORGANIZATION POLITICS														
2	Past political battles in the organization										✓				